

## FIRST RECORD OF A SPATANGOID ECHINOID FROM THE PALEOCENE OF THE PERTH BASIN, WESTERN AUSTRALIA

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### ABSTRACT

A new species of a spatangoid echinoid, *Hemifaorina? rex*, is described from the upper part of the Late Paleocene Kings Park Formation. The outer layer of the test of the material upon which the species is based is not preserved. Consequently, the lack of preservation of fascioles makes the generic assignment tentative. This represents the first echinoid species described from the Tertiary of the Perth Basin. *Hemifaorina* had previously only been described from the Miocene of Java.

### INTRODUCTION

During the construction of the Narrows Bridge across the Swan River in Perth, Western Australia in the early 1970's a number of caissons were driven deep into the Kings Park Formation. Two of these caissons, N6 L2 and N6 L3, situated north-west of the elevated road that leads off the southern end of William Street onto the northern approach road to the Narrows Bridge (Narrows Interchange Project locality of Quilty, 1974a), yielded a quantity of fossil material, including, in addition to a hitherto undescribed species of echinoid, molluscs and corals. Collections made by Mr P.R.I. Saunders of the Main Roads Department and Mr G.W. Kendrick of the Western Australian Museum in November 1971 contain, in addition to the echinoid, the nuculanid bivalve *Sarepta* sp., the propeamussiid bivalve *Parvamussium* sp., the carditid bivalve cf. *Glans* sp., the laternulid bivalve cf. *Laternula* sp. and a generically indeterminate pectinid bivalve; the scaphopod *Laevidentalium* sp.; the turbinellid gastropod *Columbarium* sp.; an indeterminate naticid gastropod; and indeterminate corals, cephalopods and possible annelids (G.W. Kendrick, pers. comm.).

This paper describes the echinoid material from this collection and, questioningly, places it in the schizasterid echinoid genus *Hemifaorina*. This genus has previously only been described from the Miocene of Java (Jeannet and Martin 1937).

### AGE AND STRATIGRAPHY

Seven echinoids, all assignable to the same species, were collected from Caisson N6 L3 at a level 5 m below the top of the Kings Park Formation. At this location the top of the Kings Park Formation is 32 m below State mean sea level (SMSL). The bottom of the Kings Park Formation in this caisson was in excess of 300 m below SMSL (Quilty 1974a). In the Perth region the formation is known to reach over 500 m in thickness (Playford *et al.* 1975), but nowhere does it outcrop at the surface.

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The Kings Park Formation consists of dark, glauconitic shales, siltstones and sandstones. The lithology of the top of the section from where the echinoids were collected consists of a dark-grey, glauconitic, fine-grained, lithic sandstone, rich in small shell fragments. McGowran (1964) regarded the entire Kings Park Formation as being of Late Paleocene age. However, Quilty (1974a,b) considered that the formation ranges in age from Late Paleocene to Early Eocene (planktonic foraminiferal zones P4 - 6). According to Quilty (1974b) the Kings Park Formation onshore is entirely Late Paleocene (P4) in age. His analysis of material from the Narrows Interchange revealed that the formation was entirely of Late Paleocene age. Consequently, the newly described species of *Hemifaorina?* is assigned a Late Paleocene age.

The Kings Park Formation is considered (Quilty 1974a) to have been deposited in a shallow marine environment, on the basis of the faunal elements. The thick sequence close to the course of the present Swan River represents infilling of a deep valley incised into underlying sediments by an ancestral Swan River. This valley may have connected with the Perth Canyon which cuts the continental slope west of Rottnest Island (Cockbain 1990).

## MATERIALS AND METHODS

All specimens of the new species are housed in the invertebrate palaeontology collections of the Western Australian Museum (WAM). A specimen referred to with the prefix RGM is from the collections of the Nationaal Natuurhistorisch Museum, Leiden. All of the specimens from the Kings Park Formation have been dorso-ventrally flattened; thus it was not possible to measure test height. Measurements were made with an electronic calliper to an accuracy of 0.1 mm. A number of parameters are expressed as percentages of test length (%TL).

## SYSTEMATIC PALAEONTOLOGY

### Order Spatangoida Claus, 1876

### Family Schizasteridae Lambert, 1905

### Genus *Hemifaorina?* Jeannet and Martin, 1937

#### Type species

*Hemiaster tuber* Herklots 1854; by original designation of Jeannet and Martin 1937, p.289.

#### Remarks

Members of the Schizasteridae are usually (although not always) distinguished from members of the Hemiasteridae by the presence of a complete lateroanal fasciole. Notable exceptions include the schizasterids *Proraster*, in which the lateroanal fasciole may be incomplete or absent; *Abatus*, in which a lateroanal fasciole is present in the juvenile, but lacking in the adult stage; and *Amphineustes*, which lacks both fascioles. Furthermore, in *Brisaster*, the lateroanal fasciole may be absent or reduced in the adult (Mortensen 1951); in *Tripylus*, *Parabrissus* and *Hemifaorina* the lateroanal fasciole is incomplete; and in *Kina* it is absent (Henderson 1975). While the nature of the apical system can also assist in the familial emplacement of genera, as with the fascioles, there are exceptions to the general rule of the Schizasteridae possessing an ethmolytic apical system and the Hemiasteridae having an ethmophract apical system.

In the case of the Kings Park Formation spatangoid although the fascioles are absent, due to the nature of the preservation, the presence of an ethmolytic apical system with four gonopores

would seem to indicate that it is a schizasterid. Furthermore, the presence on the aboral surface of petals that show a distinct inequality of length, with the anterior being much longer than the posterior, is a feature of a number of schizasterids. The presence of only a faint anterior notch, and the form of the petals, is a combination only found in one poorly known schizasterid, *Hemifaorina* from the Miocene of Java (Jeannet and Martin 1937). Although the hemiasterid *Hemiaster* (*Trachyaster*) has an ethmolytic apical system with four genital pores, most species assigned to the subgenus *Trachyaster* possess deeper petals and a more pronounced anterior notch than the Kings Park Formation spatangoid. Furthermore *Trachyaster* species have more widely divergent anterior petals and less disparate petal lengths. Thus the Kings Park Formation spatangoid is morphologically closest to *Hemifaorina*.

Although Mortensen (1951) characterised *Hemifaorina* as possessing both peripetalous and lateroanal fascioles, he omitted to point out that the lateroanal fasciole was incomplete. Inspection of type material of *Hemifaorina tuber* has revealed that the lateroanal fasciole is only present as a thin thread beneath the periproct, as in some specimens of *Proraster* (McNamara and Philip 1980). *Hemifaorina* is characterised by its ovoid test outline; poorly defined anterior notch, apical system set just posterior of centre; moderately depressed ambulacrum III aborally; and broad petals, the anterior of which are not highly divergent and which are much longer than the very short posterior petals, being about three times their length. All of these features are shared by the Kings Park Formation schizasterid, and indeed it is hard to distinguish between the two forms on the basis of aboral coronal characteristics alone.

### *Hemifaorina? rex* sp. nov.

Figures 1, 2A

#### Holotype

WAM 71.1518 (Figures 1A,B;2A) from Perth, Western Australia; at a depth of 35 m below SMSL in Caisson N6 L3 of Narrows Interchange system, which is beneath slipway leading from William Street onto the Narrows Bridge, close to junction of William Street with The Esplanade; Kings Park Formation (Late Paleocene, planktonic foraminiferal zone P4), 5 m below the top of the formation.

#### Paratypes

WAM 71.1502-71.1507 from same horizon and locality as the holotype.

#### Etymology

From the Latin *rex*, meaning 'king', alluding to the occurrence of the species in the Kings Park Formation.

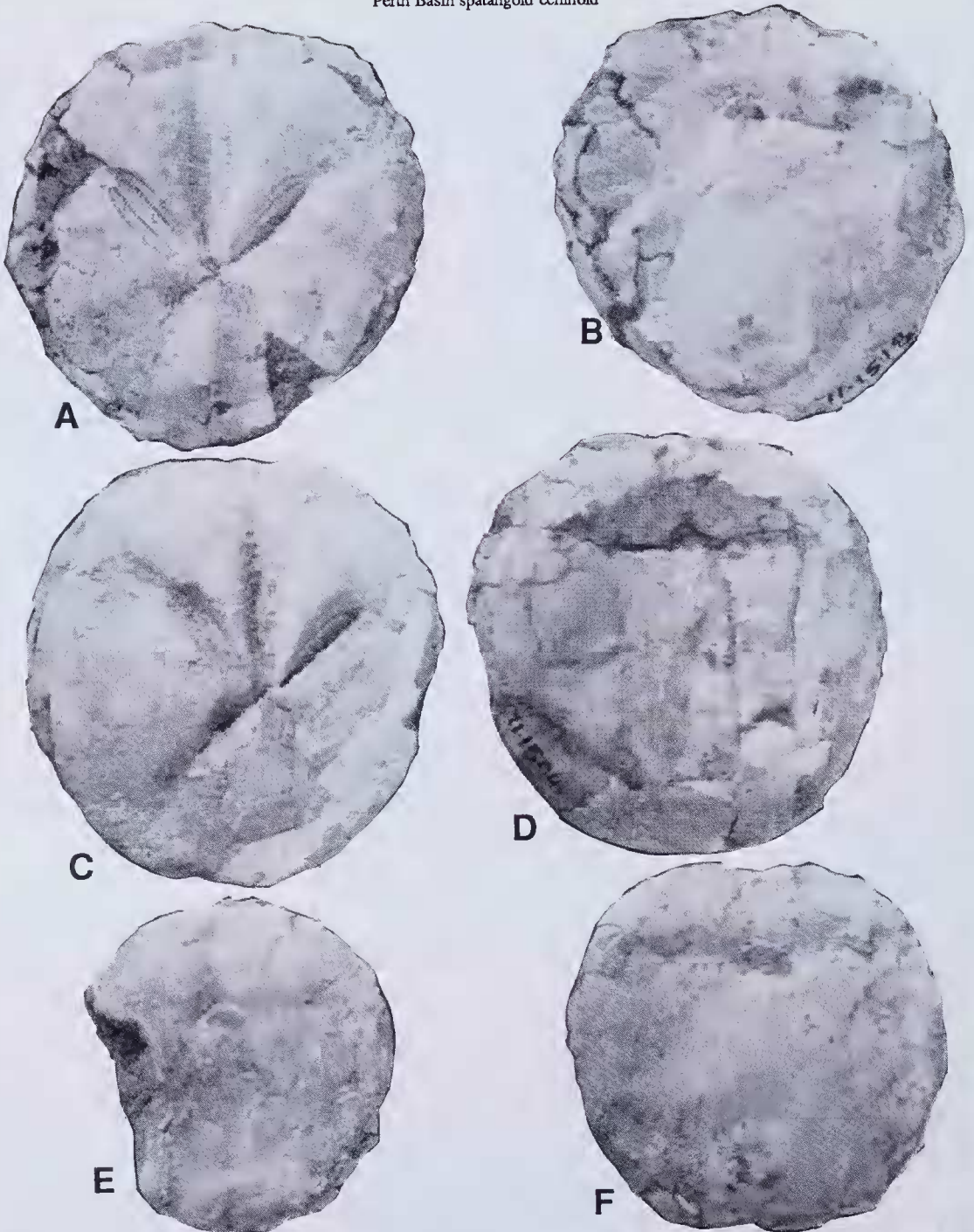
#### Diagnosis

Ambulacrum III with about 20 near transverse pore pairs aborally; peristome small; labrum almost transverse anteriorly, not projecting anteriorly across labrum; posteriorly initially strongly constricted, before widening to about peristome width where abuts plastron.

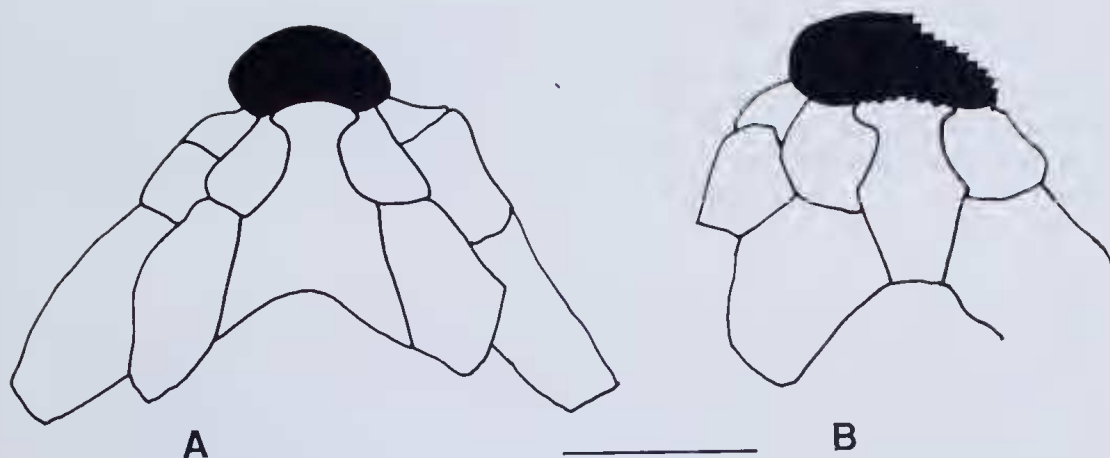
#### Description

Test outline subcircular, reaching up to 46 mm TL; anterior notch weakly developed; although all specimens have been crushed to varying degrees, it is apparent that the test is highest posteriorly in interambulacrum 5, midway between apical system and posterior ambitus, forming a distinct keel; original height unknown due to effects of compaction; test slightly wider than long ranging between 97-98% TL. Apical system posteriorly eccentric, 54-56% TL from anterior ambitus; ethmolytic, with four genital pores.





**Figure 1** *Hemifaorina? rex* sp. nov, Kings Park Formation (Late Paleocene) from Caisson N6 L3 of Narrows Interchange system, Perth, Western Australia. A, B, WAM 71.1518, holotype, aboral and adoral views respectively; C,D, WAM 71.1504, paratype, aboral and adoral views respectively; E, WAM 71.1503, paratype, adoral view; F, WAM 71.1502, paratype, adoral view; all x1.4.



**Figure 2** A, labrum of *Hemifaorina? rex* sp. nov., WAM 71.1518; B, labrum of *Hemifaorina tuber* (Herklots), RGM 4280. Bar represents 5 mm.

Ambulacrum III relatively broad, rows of pore pairs about 10%TL apart; moderately incised close to apical system, but shallows a little abapically; bears about 20 pore pairs, within a pair each pore separated by raised interpore partition; pores almost transversely aligned in a pair (Figure 1A); slightly oblique adapically. Anterior petals deep; broad, width 10-13%TL; diverge anteriorly at about 90°; slightly flexed antero-laterally; relatively long, 30-31%TL in two specimens (WAM 71.1518 and 71.1504), but 35%TL in WAM 71.1502; bear about 38 pore pairs; pores within each pair widely spaced, elongate, not conjugate. Posterior petals also deep; much shorter than anterior, 10-12%TL, that is about one-third the length of anterior petals; bear about 16 pore pairs in each row.

Peristome narrow, width 10-13%TL; slightly sunken; form of phyllode unknown; peristome situated 20-22%TL from anterior ambitus. Labrum long, up to 12%TL; decreases slightly in width posteriorly initially, then progressively widens posteriorly to become wider than peristome and over twice width at constriction (Figure 2A); anteriorly labrum does not project forward. Plastron length 43%TL; width 36%TL; almost flat; like some other adoral interambulacral plates on specimen WAM 71.1502 (Figure 1F) has five prominent growth lines on the plastron arranged around a central growth line-free area. Periproct unknown.

## Discussion

The aboral surface of the test of *Hemifaorina? rex* is almost identical to that of the Javanese Miocene species *Hemifaorina tuber* (Herklots 1854), both species sharing the characteristic features of the genus, notably a very shallow anterior notch and very short posterior petals that are about one-third the length of the anterior pair (Jeannet and Martin 1937, Fig.60). The only way that the two species can be distinguished is in the shape and size of the peristome and labrum. In *H? rex* the peristome is 10-13%TL in width, whereas in *H. tuber* it is 15-16%TL wide. The labrum of *H? rex* differs from that of *H. tuber* in being very wide posteriorly. In *H. tuber* the labrum is similar to that of *H? rex* anteriorly, but instead of continuing to widen posteriorly from the median constriction, it narrows close to the plastron (Figure 2B). This occurs because of lateral growth of the adjoining ambulacral plates.

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